Code No: R1621016 **R16** SET - 1

II B. Tech I Semester Regular Examinations, October/November - 2017
FLUID MECHANICS
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer**ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) How does the viscosity of air vary with temperature? (2M)
   b) State the condition for Irrotational flow (2M)
   c) Explain any one application of momentum equation (2M)
   d) Discuss the practical applications of Reynolds experiment. (2M)
   e) Write the expressions for c_v , c_c and c_d for an orifice (3M)
   f) Define displacement and momentum thickness. (3M)

PART -B

2. a) Explain the differences between manometer and mechanical gauges. What are the different types of mechanical pressure gauges (7M)
   b) A metal ball weighs 9500N in air and 8000N in water. Find out its volume and specific gravity. (7M)

3. a) Explain the terms: (i) Path line (ii) Streak line (iii) Stream line (iv) Stream tube. (7M)
   b) A pipe, through which water is flowing, is having diameters 40 cm and 20 cm at the cross-sections 1 and 2 respectively. The velocity of water at section 1 is 5 m/s. Find the velocity head at the sections 1 and 2 and also rate of discharge. (7M)

4. a) State and derive Bernoulli's theorem, mentioning clearly the assumptions underlying it. (7M)
   b) A 30 cm diameter horizontal pipe terminates in a nozzle with the exit diameter of 7.5 cm. If the water flows through the pipe at the rate of $0.15m^3/s$. What force will be exerted by the fluid on the nozzle? (7M)

5. a) What are the different losses in flow through the circular pipes?. (7M)
   b) Define minor losses in pipes and obtain equation for any four losses. (7M)

6. a) What are the applications of Venturimeter? Explain the working principle of venturimeter. (7M)
   b) What are the different types of notches? Explain Rectangular and Stepped notches (7M)

7. a) What is a boundary layer? Differentiate between a laminar and turbulent boundary layer. (7M)
   b) Explain Boundary layer separation with a neat sketch. What are the conditions under which separation takes place? (7M)
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Code No: R1621016 **R16** SET - 2

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FLUID MECHANICS
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2. Answer**ALL** the question in **Part-A**
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PART –A

1. a) Explain atmospheric, gauge and vacuum pressures. (2M)
   b) What is center of pressure? (2M)
   c) Explain any one application of momentum equation (2M)
   d) State Darcy-Weisbach equation. (2M)
   e) Write the empirical formulas for discharge over a rectangular weir? (3M)
   f) What are the characteristics of laminar boundary layer? (3M)

PART -B

2. a) Define the following fluid properties: (7M)
   Density, weight density, specific volume and specific gravity of a fluid.
   b) An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m × 0.9 m and an inclined plane having an angle of inclination 20^0. The weight of the square plate is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/s. Find the dynamic viscosity of the oil (7M)

3. Distinguish between: (14M)
   (i) Steady flow and un-steady flow,
   (ii) Uniform and nonuniform flow,
   (iii) Compressible and incompressible flow,
   (iv) Rotational and irrigational flow (v) Laminar and turbulent flow.

4. a) What are the applications of Momentum equation? Explain. (7M)
   b) Describe the procedure of finding the forces on pipe bend. (7M)

5. a) Explain how the following flow problems are analyzed. (7M)
   i) Series pipe connection (ii) parallel pipe connection and iii) Equivalent pipe connection.
   b) Explain how Reynold's experiment is conducted in the lab and bring its practical uses. (7M)
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Code No: R1621016 **R16** SET - 2

6. a) A Pitot tube was used to measure the quantity of water flowing in a pipe of 0.30m diameter. The water was raised to a height of 0.25m above the centre line of pipe in the vertical limb of the tube. If the mean velocity is 0.78 times the velocity at the centre and coefficient of Pitot tube is 0.98, find the discharge in the pipe line. The static pressure head at the centre of the pipe is 0.2 m. (7M)

   b) A Venturi-meter is provided to measure the water flowing through a horizontal pipe of25 cm diameter. The throat of the venture- meter is 12cm. The pressure of water flowing through the pipe is 1.5 bar and the vacuum measured at the throat is 30 cm of Hg. Find the water flow rate through the pipe. Take Cd=0.975. (7M)

7. a) Derive Von Karman momentum integral equation. (7M)

   b) Define energy thickness. Derive an expression for the energy thickness (7M)

Code No: R1621016 **R16** SET - 3

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FLUID MECHANICS
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Time: 3 hours Max. Marks: 70

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2. Answer**ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Define the terms surface tension and capillarity. (2M)
   b) Write about flownet analysis. (2M)
   c) Explain how to find out the force on a pipe bend. (2M)
   d) Discuss minor losses in pipes. (2M)
   e) Define orifice and write its classification w.r.t shape and size? (3M)
   f) Define local and average drag coefficients and write corresponding empirical relations? (3M

PART -B

2. a) What is the importance of a manometer? Explain the types of manometers in brief. (7M)
   b) Explain the term total pressure acting on a plane surface immersed in a fluid at any angle. Obtain an expression for this, and also for the corresponding depth of the centre of pressure (7M)

3. a) Define stream function and velocity potential. What are their uses? (7M)
   b) Determine whether the following velocity components satisfy the continuity equation. i) $u = cx$, $v = -cy$ ii) $u = -cx/y$, $v = c \log xy$ (7M)

4. a) State the assumptions made in the derivation of Bernoulli's equation. State the momentum equation and explain its significance. (7M)
   b) What are the surface and body forces associated with fluid flow? How are they incorporated in Euler's equation? (7M)

5. a) Define 'Hydraulic gradient line' and 'Total energy line'. The cross section of a pipe carrying a given discharge is suddenly enlarged. What would be the ratio of the two diameters of the pipe if the magnitude of the loss of head at this change of section is same irrespective of the direction of flow? Assume CC = 0.64. (7M)
   b) Derive an expression for the loss of head due to friction in flow through circular pipes. (7M)
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Code No: R1621016 **R16** SET - 3

6. a) Differentiate between stagnation pressure head and static pressure head with reference to a pitot tube. Explain with the help of a neat sketch. (7M)
   b) A Venturimeter of throat diameter 5cm is fitted into a 12.5 cm diameter water pipe line. The coefficient of discharge is 0.96. Calculate the flow in the pipe line when the reading on a mercury water differential U tube manometer connected to the upstream and throat sections shows a reading of 20 cm. (7M)

7. a) Define physically and mathematically the concept of displacement, momentum and energy thickness of a boundary layer. (7M)
   b) Water is flowing over a thin smooth plate of length 5m and width 2.7m at a velocity of1.2 m/sec. If the boundary layer flow changes from laminar to turbulent at a Reynolds number 5×10^5. Find: (7M)
      i) The distance from leading edge up to which boundary layer is laminar and
      ii) Thickness of the boundary layer at the transition point.

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SET - 4

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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) Define Pascal's law. (2M)

   b) Derive momentum equation. (2M)

   c) What do you mean by surface and body forces? (2M)

   d) What are TEL and HGL? Explain. (2M)

   e) Write a short note on Broad Crested weir? (3M)

   f) Write a short note on Magnus effect? (3M)

PART -B

2. a) What is metacentric height? Explain how the it is calculated. (7M)

   b) What are the modes of measuring pressure? How can you convert the pressure in KPa into the liquid columns and vice versa. (7M)

3. a) The flow field is given by $\psi = x^3y$ Check whether the given field exists or not? Further check whether it is irrotational? (7M)

   b) Given that $u = x^2 - y^2$ and $v = -2xy$, determine the stream function and potential function for the flow (7M)

4. a) Derive Bernoulli`s equation from Euler`s equation of motion. (7M)

   b) A pipe through which water is flowing, is having diameters, 20cm and 10cm at the cross-sections 1 and 2 respectively. The velocity of water at section 1 is given as 4 m/s. Find the velocity head a sections 1 and 2 and also rate of discharge (7M)

5. a) Explain with neat sketch the Reynold's experiment and define Laminar and Turbulent flow. (7M)

   b) A compound piping system consists of a1600m of 0.4m diameter, 1200m of 0.3m diameter and 800m pipe of 0.25m diameter cast iron pipes connected in series. Convert the system to (i) an equivalent length of 0.4m pipe and (ii) an equivalent size pipe 3000m long. (7M)
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Code No: R1621016 **R16** SET - 4

6. a) A Venturimeter has its axis vertical, the inlet and throat diameters being 150mm and 80 mm respectively. The throat has 220mm about inlet and coefficient discharge is 0.96. Petrol of specific gravity 0.78 flows up through the meter at a rate of 0.029 m^3/s. Find the pressure difference between the inlet and the throat. (7M)

   b) A 150mm X 75mm Venturi meter with a coefficient of discharge 0.98 is to be replaced by an orifice meter having a coefficient of discharge 0.60. If the both the meters are to give the same differential mercury manometer reading for a discharge of 100 liters per second and the inlet diameter is to remain 150mm. what should be diameter of the orifice? (7M)

7. a) What do you understand by Boundary Layer? Explain the development of Boundary layer over a flat plate. (7M)

   b) What do you mean by boundary layer separation? What is the effect of pressure gradient on boundary layer separation? (7M)